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(54) Packaged microwaveable brown and serve food product

(57) In a packaged brown and serve product, that readily browns upon heating with microwave energy, browning is achieved by the combination of treating at least one surface of the product with a coating comprising an amino acid source, a reducing sugar, an oil and an edible surfactant, the coating prior to application having a pH of at least 7, and packaging of the product in a container having a microwave susceptor, adjacent to but not substantially touching the treated surface of the product.

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PACKAGED MICROWAVABLE BROWN AND SERVE FOOD PRODUCT

The present invention relates to a packaged brown and serve product which browns on the product's surface when heated by means of microwave energy. The present invention also relates to a process for producing a brown and serve product, including the use of a unique composition for the browning of the product when heated with microwave energy prior to serving.

Sales of microwave ovens have undergone tremendous growth in the United States and other developed countries, including the United Kingdom, to the point where they now are extensively used. Usage of the microwave oven for the cooking or heating of foodstuffs has led to extensive development by the food industry of products which are capable of rapid cooking or heating in microwave ovens. However, the unusual manner in which microwave energy heats food products creates difficulties in producing a product which performs comparably with a product that has been cooked in a conventional oven. For example, a gas fired oven may be maintained at temperatures of from 300°F to 400°F (149 to 205°C), at which browning of the surface of the food product during baking or cooking is readily obtained. In contrast, in microwave ovens, the air temperature in the cooking space of the microwave oven is approximately at room temperature. Any rise in temperature in this space is due primarily to heat loss from the food product which is being cooked. Microwave energy interacts with the particles of the food (or with components of those particles) and instantly produces heat within the food mass, which results in the typical rapid cooking obtained by microwave ovens. As previously noted, however, the low surface temperatures

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existing in the microwave oven, coupled with evaporative cooling effects that take place on the surface of the food product, limits the crisping or browning of many foods when they are cooked in microwave ovens. Baked products or "brown and serve" products, such as bread or rolls, are a particular problem since these products, when cooked by microwave energy, appear light in colour and generally appear unbaked, even though the interior may have been fully cooked. This limits the preparation of "brown and serve" products by the consumer only to conventional gas or electric ovens, since these products are normally designed to require no cooking except for colour or surface browning.

A number of procedures have been proposed to provide dough-based products that brown when cooked or heated in a microwave oven. U.S. Patent No. 4,448,791 describes a composite dough material which has an unreactive substrate layer, which does not brown upon exposure to microwave energy, and an outer layer of a reactive dough composition, which contains a reducing sugar and an amino acid, that browns upon exposure to microwave cooking. This type of product, however, is complex and difficult to process because of the composite dough layer.

A variety of browning compositions have also been proposed, which, when applied to the surface of the food product, cause browning upon exposure to microwave energy. There are, however, restrictions upon the nature of such compositions, since they must have a flavour and appearance which are compatible with the food product to which they are applied. An example of such a browning composition is disclosed in U.S. Patent No. 4,252,832, which describes an aqueous syrup comprising a caramelized disaccharide. U.S. Patent No. 4,518,618 also describes a coating composition for

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browning foodstuffs which comprises a combination of three salts, such as potassium acetate, potassium chloride and sodium bicarbonate. The article by Copson et al. in "The Journal of Agricultural and Food Chemistry", May 1955 at p. 424, describes a variety of browning methods using coating compositions comprising mixtures of a reducing sugar and an amino acid, in which sodium carbonate or sodium hydroxide is used to control the pH to about 10 for improved colour development.

An alternative approach to achieving browning in microwave cooking is by the use of a microwave susceptor, which usually comprises a laminate of a support surface, such as paper board, and a foil or metal material which is susceptible to the absorption of microwave radiation and which becomes hot when exposed to microwave radiation. Examples of packages of this type, designed to brown the product in a microwave oven, are disclosed in U.S. Patents No. 4,641,005, 4,661,671 and 4,190,757. Disadvantages of the use of a microwave susceptor are that it must contact the surface of the food product in order to produce browning and that it does not always provide a uniform degree of browning on the product surface.

The present invention provides a packaged "brown and serve" baked product, such as bread or rolls, which browns on the surface when heated with microwave energy and is capable, if so required, of browning uniformly.

Thus, in accordance with the present invention, there is provided a brown and serve product packaged in a container which has a microwave susceptor adjacent to at least one surface of the product but not in substantial contact therewith, said product having a surface coating which has a pH of at least 7 and which comprises an aqueous dispersion of an amino acid source,

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a reducing sugar, an oil and an edible surfactant.

The product of the present invention preferably comprises a typical "brown and serve" product which has been fully formed and prebaked to the exact size and shape required, except for any desired surface colouration or browning. The brown and serve product of the present invention is also packaged in a container having a microwave susceptor or microwave heater element, which absorbs microwave energy and releases heat. The microwave susceptor layer of the container employed in the present invention is adjacent to a surface of the product but is not in substantial contact therewith, and is preferably not in contact with the product at all. The brown and serve product of the present invention also has a surface coating comprising a browning composition containing an amino acid source, a reducing sugar, and an oil, together with an edible surfactant, said coating having a pH of at least 7. The combination of a microwave susceptor, which does not contact the surface of the product, and the browning composition applied to at least one surface of the product, provides a means for uniform browning of brown and serve products in microwave oven.

The result is a brown and serve packaged product that can be easily and efficiently browned in a microwave oven. It also overcomes the disadvantages of complexity and economics associated with previously proposed procedures for browning during microwave cooking.

The present invention provides a unique means for the browning of a variety of packaged foodstuffs in a microwave oven, although it is intended primarily to be used with dough-based products, such as bread, rolls and pastries, which, if not browned, appear uncooked to the

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consumer. Preferably, the "brown and serve" products to which the present invention may be applied are rolls, breadsticks, pretzels, breads or pastries or other such products of the type that are fully formed and prebaked to the exact shape and size required, except for surface browning. These products are then designed to be browned by the consumer in their own microwave oven to provide hot bakery products.

The process for producing brown and serve bakery products involves baking yeast-raised products to a point at which they have achieved rigidity and full volume without any degree of browning. Any conventional process for preparing this type of product may also be employed for producing the brown and serve product used in the present invention, and the exact manner of preparation of the brown and serve product does not form part of the present invention. However, by way of example, this type of product is typically obtained by a conventional baking process but in which the oven temperature is reduced from its usual higher value to a value of from 230 to 320°F (110 - 160°C) and by properly conditioning the dough so as to minimize the undesirable oven spring that normally results from baking this type of product at lower temperatures than normal. Although the following general conditions should not be considered as limiting and may be varied as is well known in the art, nevertheless, dough consistency for preparing a brown and serve product should be stiffer than normal to promote the desired product rigidity directly from the oven. Straight dough calls for higher mixing temperatures in the range of from 78 to 85°F (25 - 30°C), although sponge dough may be mixed at normal temperatures. Both the yeast and the yeast food employed in the dough should be employed at slightly lower levels than normal to prevent excessive oven spring. Generally a fairly rich formula, especially

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with respect to shortening and eggs, is preferred, since those materials contribute to the flavour, aroma and eating quality of the finished product. Baking is normally and preferably carried out within a temperature range of from 230 to 320°F (110 - 160°C) for as long as possible to produce a baked product without the appearance of a brown surface or crust. At this temperature, a baking time of from 15 to 25 minutes would be adequate in most cases to impart a significant degree of rigidity to the product; however, the exact baking time for any particular dough mix may readily be determined by simple trial and error, if it is not already known. The interior temperature of the brown and serve product would typically be over 170°F (77°C) as the product leaves the oven, otherwise it tends to collapse upon cooling. Following baking of the product, subsequent cooling and packaging of the material is most preferably done under highly sanitary conditions in order, on the one hand, to reduce the possibility of mould development and, on the other hand, to preserve the unique appearance of the product. The procedure described above represents a typical but non-limiting description of a process which may be used to prepare brown and serve products and it is apparent that variations therein or other procedures may be readily carried out and the present invention is not intended to be limited by the specific process used to prepare the baked goods to which the present invention may be applied.

Following preparation of the brown and serve product, a surface coating is applied to at least one surface of the product. This coating comprises an aqueous solution or dispersion of: an amino acid source; a reducing sugar; an oil; and an edible surfactant. The aqueous solution or dispersion should have a pH of at least 7 prior to application to the surface of the

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product. A variety of materials may be employed as the components of the coating which is applied to the surface of the product, and the exact material chosen may depend upon the flavour and other characteristics desired in the final product, as well as upon the ability of the material to provide the browning required by the present invention.

For example, the amino acid source can include various proteinaceous materials such as egg albumin, soy protein, casein and other proteinaceous materials or alternatively pure amino acids may be employed. If an amino acid is employed, glycine is specifically preferred as the amino acid source in the present invention, although it is apparent that other amino acids or sources of amino acids including amino acid hydrolysates may be employed, provided that they do not adversely affect the flavour of the dough based product to which the coating is applied. Typical levels at which the amino acid source is employed are from 0.05 to 20% by weight of the coating composition, depending on whether the amino acid source is a proteinaceous material or a pure amino acid. For example, if a proteinaceous material is used, it will preferably comprise from 5 to 20% by weight of the coating composition; on the other hand, if an amino acid is used, it will preferably comprise only from 0.05 to 5% by weight, more preferably (especially in the case of glycine) from 0.5 to 5% by weight, of the coating composition.

A variety of materials may also be employed as the reducing sugar component of the coating, including various mono- and di- saccharides such as glucose or sucrose. Alternatively, less refined (more unrefined) sources of reducing sugars, such as corn syrup solids, may be used, or; alternatively, other types of sugars,

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such as fructose may be used. Typical amounts of the reducing sugar are from 5 to 20% by weight of the coating composition. In any event, the present invention is not intended to be limited by the specific reducing sugar source that may be employed in the present invention.

The coating composition that is applied to at least one surface of the brown and serve product also employs an edible oil and a surfactant or emulsifier which significantly improves the degree of coating as well as the uniformity of the browning reaction upon heating in a microwave oven. In this regard a variety of edible oils as well as surfactants or emulsifiers may be employed in the present invention although a combination of corn oil and lecithin represents a typical and preferred combination of oil and surfactant that may be employed. Examples of other oils that may be employed in the product of the present invention include: soybean oil, edible mineral oil, groundnut oil, rapeseed oil, cottonseed oil and olive oil (which may be of any grade, including virgin and extra virgin). The oil is preferably employed at a level of from 5 to 20% by weight of the coating composition. In addition to lecithin, referred to above, examples of suitable surfactants or emulsifiers include: glycerides (mono- and di-), such as glycerol monostearate; acetylated monoglycerides; arabinogalactan; carrageenan; dioctyl sodium sulfosuccinate; glyceryl-lacto esters of fatty acids, such as oleic acid, stearic acid or palmitic acid; hydroxylated lecithin; hydroxyalkylcelluloses, such as hydroxypropylcellulose or hydroxypropylmethyl-cellulose; lactylic esters of fatty acids, e.g stearic acid; cellulose ethers, such as methyl ethyl cellulose; ox bile extract; polyglycerol esters of fatty acids; polyoxyethylene sorbitan mono- and poly- esters, such as the monolaurate, monooleate, monostearate and

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tristearate; alginates, such as propylene glycol alginate, potassium alginate or sodium alginate; sodium lauryl sulphate; sorbitan monostearate; succinylated monoglycerides; succistearin; and xanthan gum and the xanthanates. The edible surfactant or emulsifier is preferably employed at a level of from 0.5 to 20% by weight of the coating composition.

Although not critical to the practice of the present invention, other materials may also be added to the coating compositions in order to promote flavour development or taste of the product upon heating in a microwave oven; typical materials which may be employed include dry malt powder, salt and/or other seasonings or flavouring agents. Where used, these are typically added at levels sufficient for flavouring the product and typically and preferably from 1 to 20% by weight of the coating composition.

In accordance with the present invention, the pH of the aqueous dispersion applied as a coating to the brown and serve product is controlled to a value of at least about 7 and preferably from 7.5 to 10.0. A variety of alkaline materials may, if necessary, be added to the coating composition of the present invention in order to raise the pH to this level. Examples of such materials include various edible alkaline materials, especially alkali metal compounds, notably the hydroxides, carbonates and bicarbonates, such as sodium hydroxide, sodium carbonate or sodium bicarbonate or equivalent potassium compounds, any of which may be added to the aqueous dispersion or coating composition in liquid or solid form to adjust the pH to the desired value, which should be at least 7.0. It has been determined that, if the coating composition has an alkaline pH, a more enhanced degree of browning is obtained when the coating compositon is employed in the present invention.

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Following the application of the coating, the brown and serve product is then packaged in a container which may be selected from a variety of conventional materials typically employed for the heating and serving of brown and serve products, although an important factor in the present invention is the use of a packaging material which has a microwave susceptor or microwave heater element in the container. A microwave susceptor usually comprises a thin sheet or central layer of a metallic material surrounded by paper based or other packaging material which can be in either rigid or flexible form. The metal is usually a thin coating of aluminium or a combination of metals having a degree of resistivity; this metal is typically deposited on a polyester substrate, which is then bonded to the paper, paperboard or other dielectric substrate with adhesive. The polyester substrate may be covered on both sides with the paper or dielectric substrate if desired. When microwave energy is applied, resistive heating of the metal occurs, thereby generating heat.

One typical type of flexible container is a bag of the type commonly used for the microwave heating of popcorn, which comprises a moisture proof paper and polyester bag with a susceptor layer embedded in one wall of the bag. If a bread loaf is placed in the bag, the susceptor layer overlies the surface to which composition is applied without being in contact therewith. Alternatively, a more rigid type of microwave susceptor which may be employed in the present invention comprises a thin layer of aluminized film glued to a sheet of paper board, such as that manufactured by the James River Corporation, Neenah, Wisconsin, for example as generally described in U.S. Patent No. 1,011,006. With this type of container it is preferable that the microwave susceptor or heater element be shaped into a cover fitting over a pan which

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contains the brown and serve product; this microwave susceptor or heater element usually overlays the coated surface of the product and it is important for the purposes of the present invention that the microwave susceptor or heater element should not be in substantial contact with the surface of the brown and serve product and preferably should not be in contact with it at all. This is a significant difference between the present invention and those procedures employed previously which involve the use of a microwave susceptor, since those procedures require that the microwave susceptor be in direct contact with the surface of the product to cause browning during microwave heating. For the most part, direct contact usually causes non-uniform or uneven browning. In the present invention, because of the use of a unique coating composition, it is neither desirable nor essential that the microwave susceptor contact the coated or treated surface of the brown and serve product and in fact the microwave susceptor preferably does not contact the brown and serve product at all; indeed, the microwave susceptor can be at a significant distance from the surface of the brown and serve product and still provide uniform browning. Although the exact distance between the susceptor and the surface of the product is not critical to the practice of the present invention, it should preferably be at a distance sufficient to provide an air space for heating, although a typical distance is generally from 1/16 to 1/2 inch (from 0.16 to 1.27 cm). When a packaged brown and serve product having the coating composition of the present invention applied to at least one surface thereof is placed in a container with a microwave susceptor, as described above, and the package is heated in a microwave oven for about two minutes, the product browns very uniformly with a rich brown colour that is not obtainable if only the browning composition, or alternatively only the susceptor layer, is employed.

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It is therefore apparent that the combination of the microwave susceptor and browning composition employed in the production of the packaged brown and serve product of the present invention provides a unique and improved means of browning a product of this type in a microwave oven.

The invention is further illustrated by reference to the following Examples.

EXAMPLE 1

A "brown and serve" bread loaf was prepared using the following ingredients:

	INGREDIENTS	GRAMS
	Seal of Minnesota Bleached & Bromated Flour	490
	Vital Wheat Gluten	6
	Granulated Sugar	44
	Non Fat Dry Milk	30
*	Emplex emulsifier	2
**	US 500 dough conditioner	1.5
	Calcium Propionate	0.5
	Vegetable Shortening	50
***	Durkee Durem 204 Emulsifier	2.8
	Water	250
	Yeast	19
	Salt	10.2
	ADA Yeast Food KC (Optional)	0.5

* Patco Products, 3947 Broadway, Kansas City, MO 64111, USA

** Puratos Corporation, 9242 Commerce Highway, Pennsanken, NJ 08110, USA

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*** Durkee Industrial Foods Corp., 925 Euclid Avenue, Cleveland, OH 44115, USA

The ingredients listed above were assembled and mixed with a three speed, 5 quart (4.73 litres) Hobart mixer: one minute at the first speed; 12 to 14 minutes at the second speed. The final dough temperature should be 78 to 82°F (25 to 28°C).

The dough was then allowed to ferment for between 50 and 60 minutes, after which pieces were cut off and weighed to 175 grams scaling weight.

The dough pieces were then rounded and allowed to stand for 10 minutes, after which they were moulded into the appropriate white bread shape and were then placed in French basket pans. They were allowed to proof for 40 to 45 minutes at 105°F (41°C) (dry bulb), 65 - 90% relative humidity.

Baking was carried out at 255 to 285°F (123 to 140°C) for 18 to 20 minutes in an oven employing bottom heat only, which yielded the desired "brown and serve" loaf. Although the product had been completely baked, no exterior or surface browning of the bread had taken place. The loaves were allowed to cool and were then placed in appropriately sized aluminium foil pans. The finished baked weight should be approximately 160 gms.

Separately, a browning composition comprising the following materials was dry blended in the indicated amounts by weight.

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Ingredients	Grams
Egg Albumen	16.7
Corn Syrup Solids	16.7
Dry Malt Powder	25.0
Baking Soda (Sodium Bicarbonate)	16.7
Salt	0.8
Total	75.9

The above ingredients were then dry blended for 5 minutes, and an aqueous dispersion of the dry blend was prepared by blending 30.4 grams of the above mix with 20.6 grams of water and mixing until smooth. Separately, a mixture of 50 grams of corn oil and 50 grams of lecithin was prepared by blending for 2 minutes. 12.6 grams of the mixture of corn oil and lecithin was blended with the aqueous dispersion and mixed until smooth. The dispersion was allowed to stand for 5 minutes prior to use.

Approximately 4 grams of the browning composition, prepared as described above, were applied to the surface of the pre-baked brown and serve loaf. A susceptor cover, as generally described in U.S. Patent No. 4,641,005, was fitted over the aluminium pan to provide a tight fit for the container. The cover was at a distance of about 1/16 to 1/2 inch (0.16 to 1.27 cm) from the surface of the bread loaf and did not contact that surface. The entire package, with the cover and loaf, was placed in a 600 watt microwave oven and heated for about 2 minutes. At the end of this time, the container was removed and allowed to cool for several

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minutes; the cover was then removed to reveal an evenly browned loaf of bread.

EXAMPLE 2

"Brown and serve" bread loaves were generally prepared according to the procedure described in Example 1, except that the dough pieces after fermentation had a scaling weight of 145 grams. The loaves were also placed in a paperboard pan, instead of the aluminium pans specified in Example 1, for heating in the microwave oven. The loaves had a finished baked weight of about 130 grams. The browning composition of Example 1 was applied in a similar manner to that described in Example 1, and, after fitting the paperboard pan with a susceptor cover as described in Example 1, the loaves were heated in a microwave oven, again as described in Example 1. The loaves after heating in the microwave oven had an evenly browned surface.

EXAMPLE 3

A "brown and serve" bread loaf was prepared using the following ingredients:

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INGREDIENTS	GRAMS
100% Whole Wheat Flour (fine granulation)	490
Vital Wheat Gluten	20
Granulated Sugar	44
Non Fat Dry Milk	30
Emplex emulsifier	2
US 500 dough conditioner	1.5
Calcium Propionate	0.7
Vegetable Shortening	50
Durkee 204 Emulsifier	3.5
Water	310 - 340
Yeast	23
Salt	10.2

The procedure adopted was as follows:

1. The ingredients were placed in the bowl of a 5 quart (4.73 litres) Hobart mixer and mixed with a dough hook for 2 minutes at Low and 8 - 9 minutes at High speed, for a final dough temperature of from 78 to 80°F (25 to 27°C).

2. The dough was allowed to ferment for 45 minutes.

3. The dough was then rounded and allowed to relax for 10 minutes.

4. After this, it was shaped into loaves at a dough weight of 145 grams for paperboard or 175 grams for foil pans. These were placed on French basket pans.

5. It was then proofed for 30 minutes at 105°F (41°C) (dry bulb); 65 - 75% relative humidity.

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6. The loaves were then baked for 20 minutes at 225°F (107°C).

7. After the loaves had been allowed to bake, they were placed in the appropriate paperboard or aluminium foil pans; the finished baked loaf weight will be about 156 - 160 grams for an aluminium foil container and 128 - 130 grams for a paperboard container.

8. The browning composition of Example 1 was applied in a similar manner and, after fitting of either the paperboard or aluminium pan with a susceptor cover as described in Example 1, the loaves were heated in a microwave oven as described in Example 1. The loaves, after heating in the microwave oven had an evenly browned surface.

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CLAIMS

1. A brown and serve product packaged in a container which has a microwave susceptor adjacent to at least one surface of the product but not in substantial contact therewith, said product having a surface coating which has a pH of at least 7 and which comprises an aqueous dispersion of an amino acid source, a reducing sugar, an oil and an edible surfactant.

2. A product according to Claim 1, in which the amino acid source comprises from 0.05% to 20% by weight of the coating.

3. A product according to Claim 1 or Claim 2, in which the amino acid source is a pure amino acid.

4. A product according to Claim 3, in which the amino acid comprises from 0.05% to 5% by weight of the coating.

5. A product according to Claim 4, in which the amino acid source is present in an amount of from 0.5% to 5% by weight of the coating.

6. A product according to any one of the preceding Claims, in which the amino acid is glycine.

7. A product according to Claim 1 or Claim 2, in which the amino acid source comprises a proteinaceous material.

8. A product according to Claim 7, in which the proteinaceous material is present in an amount of from 5% to 20% by weight of the coating.

9. A product according to any one of the preceding Claims, in which the reducing sugar comprises from 5% to 20% by weight of the coating.

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10. A product according to any one of the preceding Claims, in which the reducing sugar is corn syrup solids and/or fructose.

11. A product according to any one of the preceding Claims, in which the oil comprises from 5% to 20% by weight of the coating.

12. A product according to any one of the preceding Claims, in which the oil is corn oil.

13. A product according to any one of the preceding Claims, in which the surfactant comprises from 0.5% to 20% by weight of the coating.

14. A product according to any one of the preceding Claims, in which the surfactant is lecithin.

15. A product according to any one of the preceding Claims, in which the oil is corn oil and the surfactant is lecithin.

16. A product according to any one of the preceding Claims, in which the aqueous dispersion has a pH of from 7.5 to 10.0.

17. A product according to any one of the preceding Claims, in which the susceptor does not contact the surface of the product.

18. A product according to Claim 1, substantially as hereinbefore described with reference to any one of the foregoing Examples.

19. A method of producing a product according to any one of the preceding Claims, which comprises:

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(a) pre-baking a dough to form a brown and serve baked product;

(b) coating said product with a browning composition comprising an aqueous dispersion of an amino acid source, a reducing sugar, and oil and an edible surfactant, said coating having a pH of at least 7; and

(c) packaging said coated product in a container having a microwave susceptor adjacent to at least one surface of the product but not in substantial contact therewith.

20. A method according to Claim 19, substantially as hereinbefore described with reference to any one of the foregoing Examples.

21. A packaged brown and serve product when prepared by a method according to either of Claims 19 and 20.

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